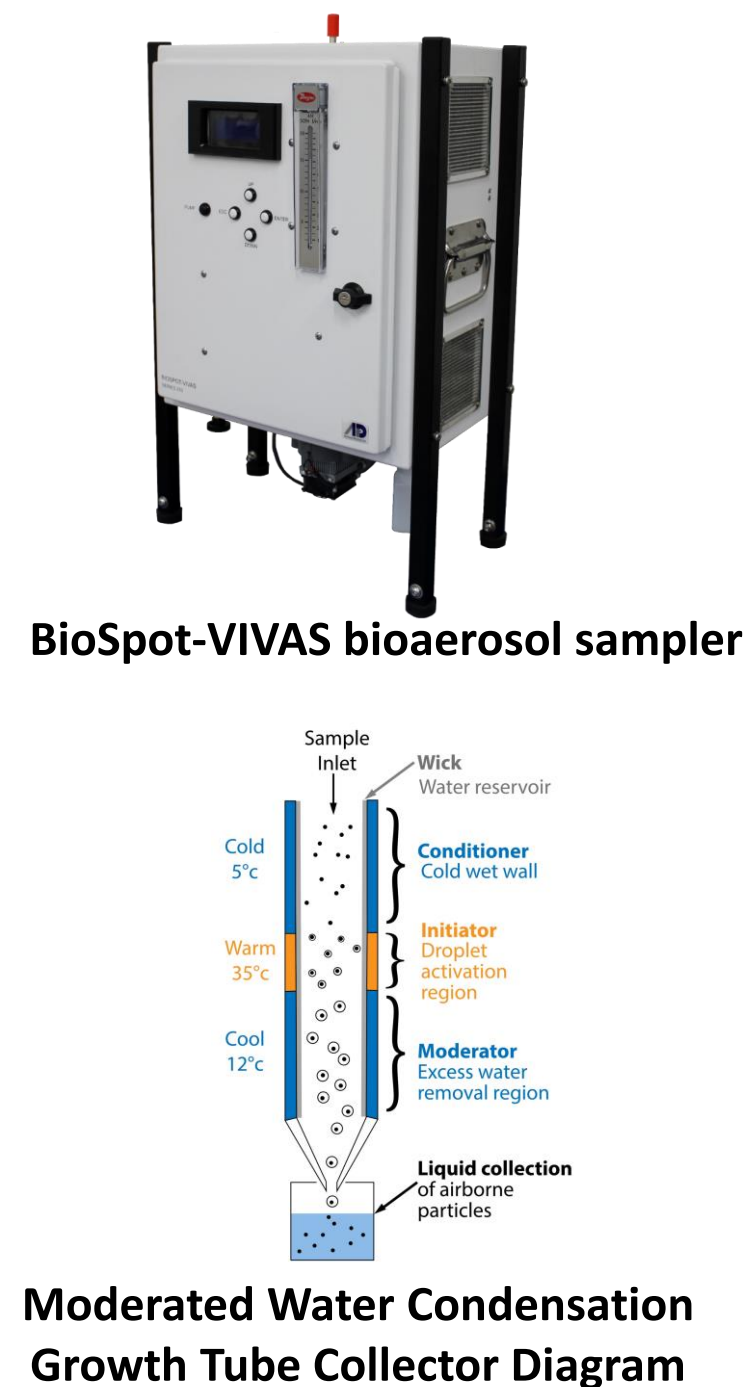


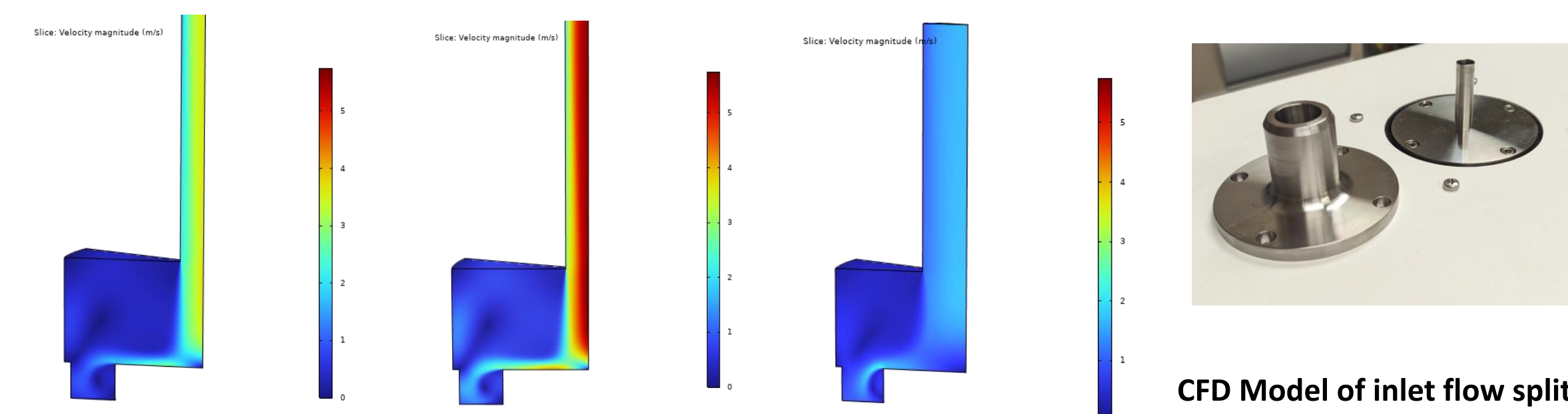
Advantages of WCGT Bioaerosol Sampling

- The **BioSpot-VIVAS™** bioaerosol sampler is designed to be a gentle, efficient, high-flow aerosol sampler to capture high quality bioaerosol samples from ambient air.
- **Robust design** manufactured for use in a variety of indoor/outdoor environments.
- **Samples viable bioaerosol** with high efficiency across a large size range (5 nm – 10 μm). 8LPM flow is similar to human breath rate.
- **Samples into COTS 35mm petri dishes** for easy sterile sampling and transportation of samples for analysis.



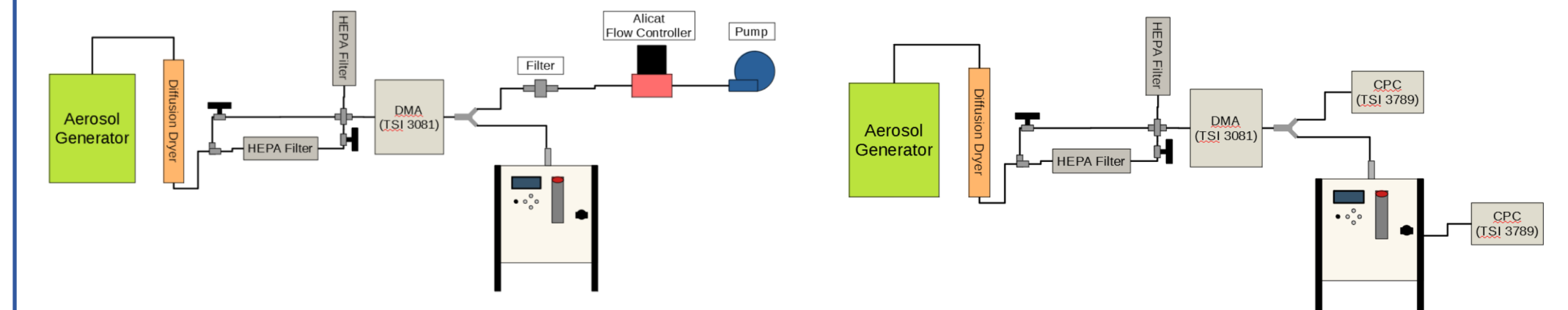
Desired Improvement

- Higher sample flow rate is desired for the instrument without excessive modification to more quickly sample low-concentration aerosol.
- However, it must be proven that the Growth Tube of the instrument can still activate and capture particles efficiently with the increased flow without losses occurring due to lack of activation or upstream impaction.
- Computational Fluid Dynamics and Particle Tracing in COMSOL was used to model how particles 1-10μm would travel through inlet of instrument.



Experimental Setup

Collection Efficiency Testing for particles 6-250nm:



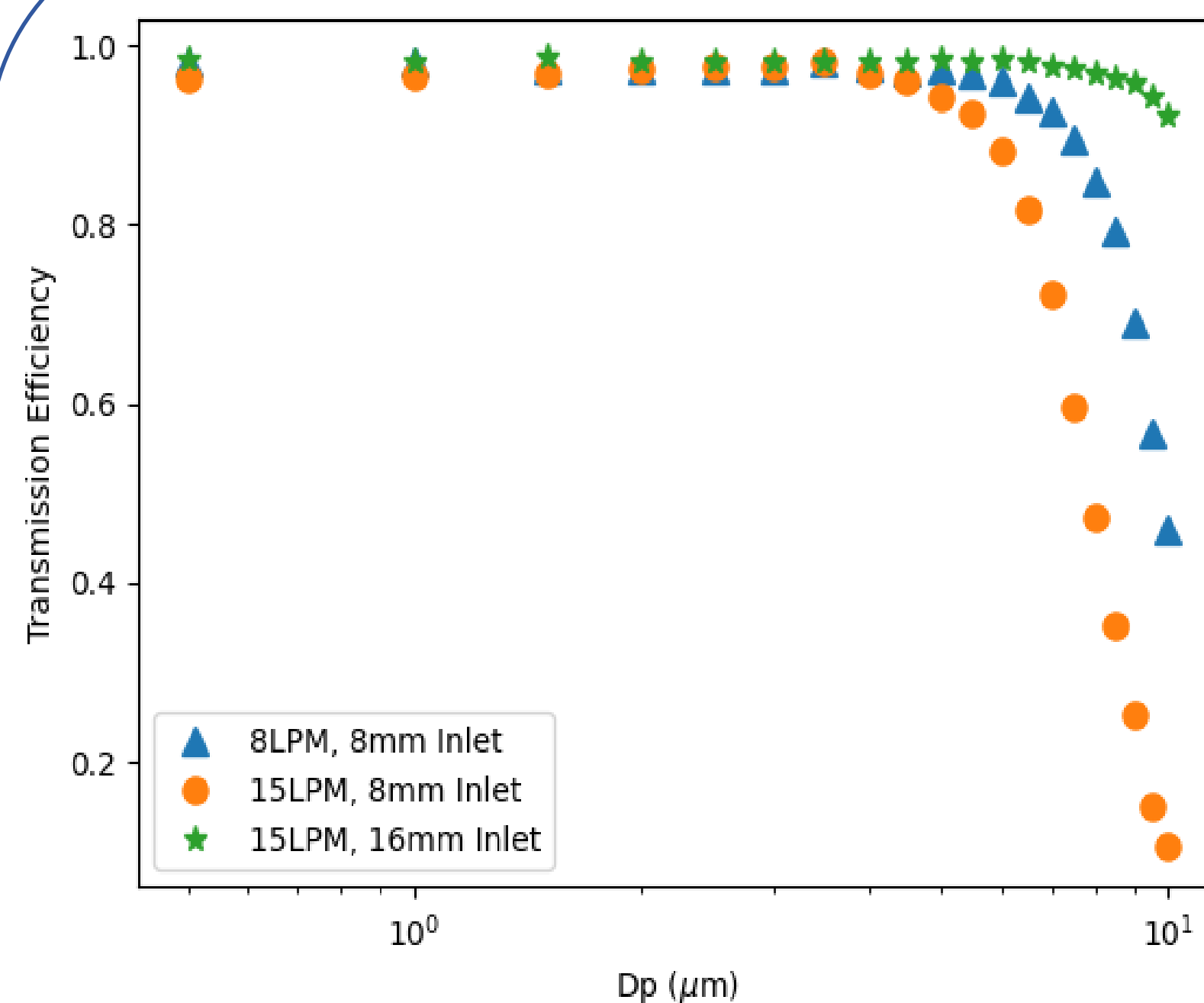
Uranine Collection Efficiency Testing

- Fluorescein sodium salt (uranine) was used for collection efficiency mass analysis.
- Flow rate through the filter is matched to the nozzle flow rate of the sampler.
- 0.01M Solution of NaOH was used to extract Uranine samples.

CPC Collection Efficiency Testing

- Counting efficiency was used to measure collection efficiency of smaller particles where uranine mass is difficult to measure.

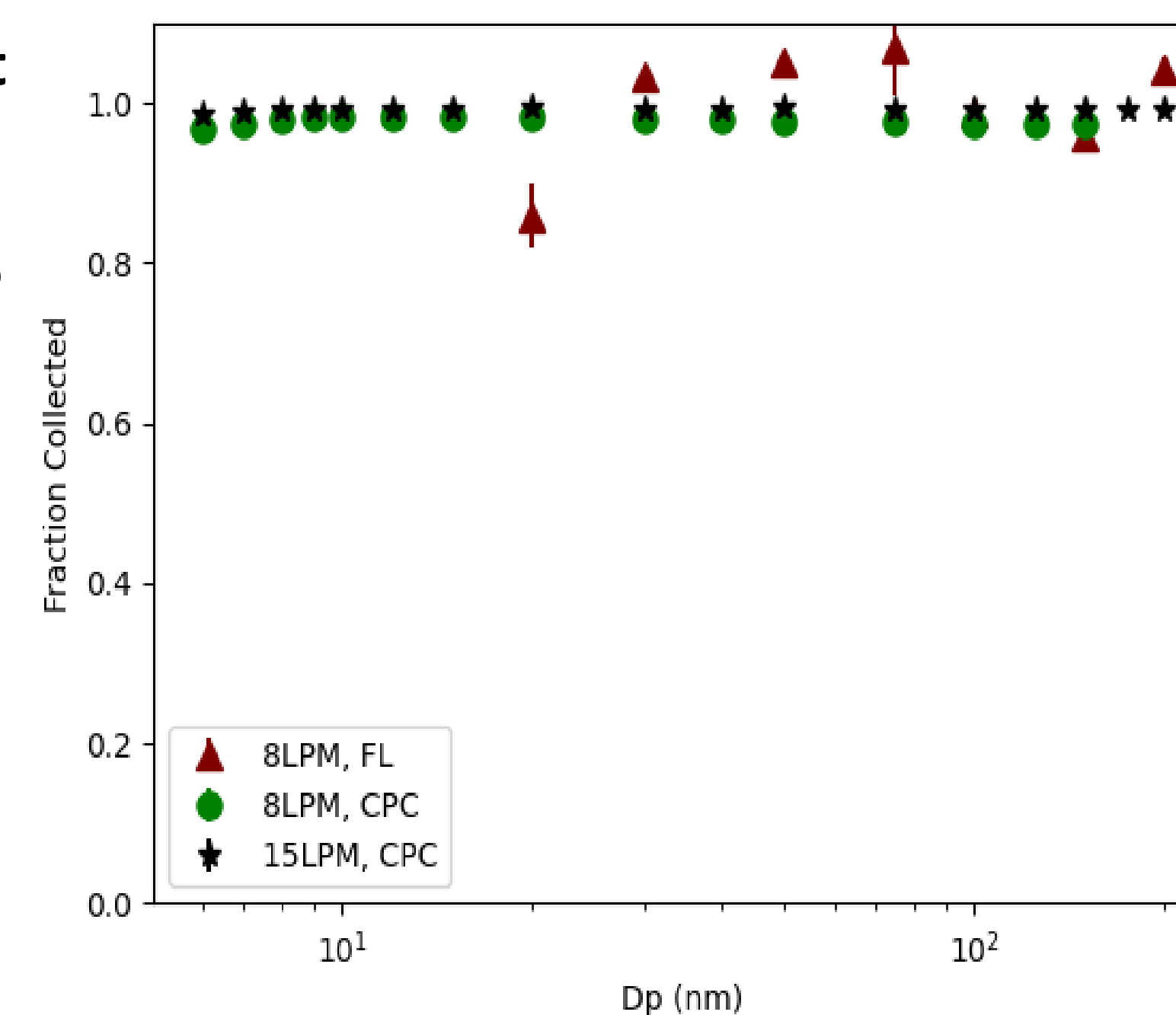
Results



CFD Study Comparing Original (8mm ID) Inlet Geometry to New (16mm ID) Inlet Geometry at Transmitting particles up to 10 micron

Transmission efficiency of redesigned inlet is > 90% across entire size range

- Transmission of particles through original inlet (8mm ID) poor, especially at higher flows due to small diameter.
- Increasing the size of the inlet to 16mm ID increases the transmission efficiency through the inlet of larger particles ($>5\mu\text{m}$) even when flow is increased to 15LPM.
- **Increasing flow of the Growth Tube to 15 LPM does not negatively effect collection efficiency**
 - Collection efficiency measured using the CPC method match across the entire size range even with increased flow rate.
 - Uranine collection efficiency testing at 15 LPM was not completed in time due to experimental issues.
 - Flow was not tested above 15LPM due to petri dish liquid being blown out by air flow.

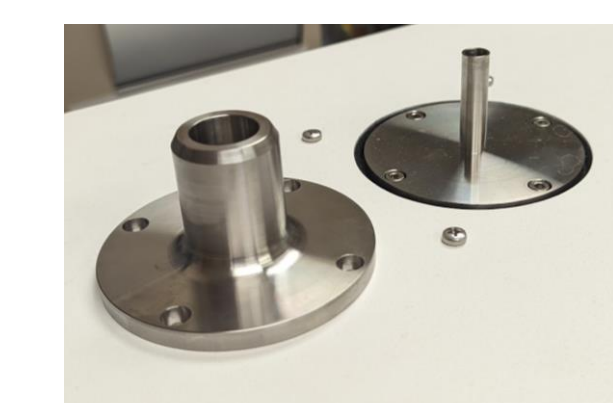


Uranine and Condensation Particle Counter Collection Efficiency Study Confirming Efficiency at Higher Flow Rates

Conclusions and Future Applications

Conclusions:

- Increasing the flow of the BioSpot-VIVAS significantly increases the amount of captured aerosol while not compromising collection efficiency across the size range.
- The inlet of the existing BioSpot-VIVAS needed to be redesigned to accommodate higher flow.



Current and Future Applications

- A high-flow version of the BioSpot-VIVAS aerosol sampler is now commercially available and upgrading of previous instruments to higher flow is possible.
- Successful ambient sampling in lower-biomass environments is now potentially possible.
- Confirming viability of captured bioaerosol at higher flow has not yet been tested.